There Ain't No Free Lunches
Banquet Address

by
T. Scott Hickman
President
Society of Petroleum Engineers

Abstract

North America enjoys abundant natural gas through indigenous production and secure imports, and is the world leader in residential, commercial, industrial, and transportation uses. Projected fossil fuel demand rises substantially until 2015; renewables/hydropower demand remains fairly constant; nuclear demand falls. Renewables/hydropower are limited by supply; nuclear is limited by safety concerns. The most available fossil fuel, coal, remains relatively dirty despite emissions cleanup, and some resistance to coal will continue. Oil probably will stay prominent long-term because of its versatility, by-products, ease of transportation, and efficiency (many Btu's in a small package), barring some artificial import shortage.

Natural gas is fairly abundant in the U.S. and North America, is clean-burning compared to coal and oil, and usually is comparatively cheap/Btu. The annual gas demand will rise from about 21.7 quadrillion Btu to 28.7 quadrillion by 2015, about 25 percent. U.S. indigenous production starts declining around 2005. This assumes existing technology and does not consider economic growth, environmental regulation that penalizes other fuels, significant price fluctuation for alternative fuels, or supply disruption for other fuels.

Despite the 1980s roller-coaster of low prices, downsizing, and lost job security, industry met the current and near-term natural gas demand through more efficient/rational business organization, enlightened government regulation, but mainly because industry professionals applied existing technology more efficiently and developed the advanced technology needed to exploit abundant tight/unconventional gas resources. To offset the U.S. capacity decline projected around 2005, there must be advances in applying (1) 3-D seismic to exploration and reservoir characterization, (2) horizontal drilling, (3) coiled tubing application, and (4) enhanced gas processing.

Annual or even quarterly earnings now measure company success, but deploying economic capital solely to optimize near-term return ignores technology, which carried us through the 1980s. Globalization makes countries dependent, not upon political/military strength or natural resources, but on intellectual capital, which is society's cumulative knowledge. Engineers and geoscientists are trustees of the intellectual capital that creates our advanced technology. Intellectual capital is a continuous investment and is supported on three pillars—academia (forwards knowledge to new generations of engineers and scientists), engineers and scientists (convert knowledge to advance technology), and industry (supports innovative engineering, professional growth, and R&D needed to expand intellectual capital). The failure of one directly

impacts the others.

Global competition values intellectual capital but has promoted cost-cutting, reorganizing, and downsizing in nearly all industries. Focusing on short-term gain jeopardizes industry's "seed corn," or its real assets: people. Yesterday's technologists are retiring or promoted to senior management; their professionalism/knowledge may not be transferred to newer blood. Career-development and continuing education are disappearing. Without mentoring, young engineers cannot gain perspective beyond their daily jobs. University engineering programs are affected and industry R&D is dwindling.

The gas industry needs continued technological development through cooperative industry/government R&D. Some DOE programs are very practical, cost-efficient, and give taxpayers a lot per dollar; many bring new technology. Government is necessary in growing intellectual capital through facilitating industry initiatives. The Society of Petroleum Engineers' primary mission is to maintain and advance intellectual capital. SPE wants to cooperate with public and governmental entities in disseminating technology, exchanging data, and providing career-growth opportunities industrywide. Engineers and geoscientists must grow technically, professionally, and continually, including technical society participation. Management must invest in intellectual capital by supporting professional growth, the industry R&D effort, and education. Truly, there are no free lunches.

Introduction by Thomas M. Torkos

(Associate Director of the Office of Project Management for the Federal Energy Technology Center)

In case everyone is trying to figure out what the Federal Energy Technology Center is, I brought a picture. [holds up page-size organization chart] I hope you can see it from there! This is a very flat organization, especially right up here—there are a bunch of flat people up there.

Before the main event, I want to give special recognition to the people that helped put together this conference, especially the Conference Service group. Two special people that helped organize this are Rod Malone, who is unable to be here, and Charlie Byrer. For anything that goes wrong, the other gentleman, Bill Lawson, takes all the credit. That is enough message from the sponsor!

This is another opportunity for us to say that we have a man of distinction to honor us with a keynote address. Scott Hickman is President of the Society of Petroleum Engineers. He also is President of T. Scott Hickman and Associates, Inc. Mr. Hickman received his B.S. in petroleum engineering from Texas Tech University and his M.S. in petroleum engineering from Louisiana Tech, with additional graduate credits toward an M.S. in geology from the University of Texas at Arlington. He is a registered professional engineer in both Texas and Louisiana. His rather broad professional experience includes 11 years at Texaco, 4 years with LLC&C Consulting Company (I apologize that I don't know what that stands for—maybe Scott will tell us), and many successes in 24 years as a member of the T. Scott Hickman and Associates group, consulting in the oil and gas business.

Of his many accomplishments, I will mention just a few. He received the Distinguished Service Award from SPE, in recognition of his length of service to that organization. He just returned from two weeks in Europe and the Middle East representing the Society. He also received the Engineer of the Year Award in 1987 from the Texas Society of Professional Engineers. He was Chairman of the Texas Tech Petroleum Engineering Industry Advisory Board during 1989 through 1993. And he was a Distinguished Alumnus of Texas Tech University in 1988.

Now it is my pleasure to introduce Scott Hickman. I didn't understand the original title of his talk, so I said, "You've got to come up with a simpler title." So he said, "OK, I've got a good one: 'There Ain't No Free Lunches!'" Scott?

Address by Scott Hickman

Thank you, Tom. By the way, LLC&C was an established consulting firm in Midland, Texas when I moved out here around 1968 or 1969. The initials stand for Lybock, Lamath, Calaway, and Campbell, referred to locally as "we the people."

It is a pleasure to be at this conference, and at this function tonight. I did change the title of my talk to "There Ain't No Free Lunch," without informing DOE [original title: "How Did We Get Here and Where Are We Headed?"]. The talk is still the same; only the title is different. Unfortunately, the talk hasn't improved any! I am starting to see that my new title for this talk is a bit ironic, because I just enjoyed a very delicious meal, courtesy of somebody—but now I am having to get up and work for it. And you are having to sit here and listen to me. So, maybe there truly are no free lunches!

U.S. Energy Demand and Natural Gas Supply

By most standards, the United States, and indeed all of North America, enjoys an abundance of natural gas through indigenous production and secure imports. We have led the world in the adoption of gas for residential, commercial, industrial, and now transportation requirements. In fact, the supply has been so abundant that for many decades we have burned it as a waste product. I started my oil field career as a 15-year old country boy, roughnecking in the spraberry boom of the late 40s and early 50s. I worked morning tour. At night, the west Texas sky was lit up in every direction by gas flares. There is no telling how many millions of cubic feet a day were going up in gas flares! So, when I remark about us burning this fuel as a waste product in the past, I know from whence I speak, because I was there and I have seen it, as have many of you.

Our immediate supply does not appear to be in question. To be sure, we have occasional peaks in demand that will cause a temporary dislocation, driving up prices artificially high for a short period, and this gets the entrepreneurs in Midland [Texas] all excited about being wealthy again. Then a week later, the prices are back down where they belong, and we come back down to Earth. For the most part, our demand is fairly easily met through an extensive network of producing, importing, and distribution infrastructure. The question we might ask is, "Will this very happy state of affairs continue into the future?" Demand for the total fuel mix will increase significantly over the next 20 years.

As shown in this slide, the demand for oil, natural gas, and coal rises substantially out to the year 2015, whereas demand for renewables and hydropower remain fairly constant, and the projected demand for nuclear actually falls. Renewables and hydropower are somewhat limited, just by the fact of their supply. As we are all aware, the potential of nuclear energy is severely limited, at least at this point in our history, because of public concern over safety and the resulting high cost to site, build, and operate nuclear plants.

The U.S. still has abundant supplies of coal. In fact, there is more accessible coal available than any other fossil fuel. However, emissions from coal, although they have been cleaned up tremendously in recent years, still make it a relatively dirty fuel. There will be some continued resistance, I think, to the future use of coal. Of all fuels in the U.S. mix, oil is probably in the best position over the long term, because of its versatility, its many by-products, its ease of transportation, and because it carries a lot of Btu's in a fairly small package. I think oil will maintain its prominent position in our energy mix, barring some artificial shortage that results from a problem with importing it.

Natural gas has to compete against these other fuels. Fortunately, natural gas has a lot of redeeming properties. It is in fairly abundant supply right here in the United States and other parts of North America. It is a clean-burning fuel, compared to coal and oil. It is comparatively cheap on a Btu basis, most of the time. Projections for natural gas supply and demand to the year 2015 are shown on this slide. We can see that the yearly demand for gas will rise from about 21.7 quadrillion Btu, currently, to some 28.7 quadrillion Btu out to the year 2015. That is an increase of about 25 percent. You will also note from this graph that the U.S. indigenous production can keep its end of the bargain only up out to about the year 2005. Then it starts falling off with increased rapidity.

Now, these are baseline forecasts. We must keep in mind that they are based on the assumption of existing technology and reserves. So, they don't take into account demand shifts from greater economic growth, or an increase in environmental regulations that would penalize other components of the fuel mix, or significant fluctuations in alternative fuel prices, or disruptions in the supply of other fuels within the mix, or a host of other scenarios we could invent that could significantly increase the demand for gas.

A Roller Coaster Ride

The decade just past could be described as a roller coaster ride of low prices and downsizing and loss of job security—for many of us, just a struggle to survive. It is really quite amazing that the industry has the capacity to meet the nation's current and near-term projected demand for natural gas. How did we do it? How did we accomplish this during a decade that has been less than kind to many of us? Certainly, more efficient and rational business organizations have helped. Certainly, enlightened government regulations have helped. But I think the credit really goes to dedicated industry professionals who have applied existing technology in a much more efficient manner, and who have developed the advanced technology required to explore the tight and unconventional gas resources that we have so abundantly in this nation.

Advances in drilling and completion now allow commercial production from reservoirs with less than one-hundredth of a millidarcy of permeability. Ladies and gentlemen, for those of you who do not work with permeability, let me give an example that is easier to understand: the concrete sidewalk outside has more permeability than some of the gas reservoirs from which we now produce!

We have done a pretty good job of rapidly exploiting coalbed methane. There are still many interesting things to do in that area.

But there is much more that must be done if North America is to have an adequate and affordable supply of natural gas well into the next millennium and if we are going to offset the decline in capacity now being projected for U.S. production about the year 2005. There must be advances in applying 3-D seismic, both to exploration and to reservoir characterization (something near and dear to my heart); advances in the use of horizontal drilling; advances in coiled tubing application (which has great promise to lower the cost of many things); and advances in enhanced gas processing, to name just a few. There are many other interesting areas, such as hydrates, that we must continue to work on. This fits in with the topic of this very timely conference: emerging technologies for the natural gas industry. We professionals can be proud of what has been accomplished in a very tumultuous period.

But what of the future? Is there light at the end of the tunnel? Will oil and gas prices remain as strong in 1997 as they were in 1996? If not, then what? If prices float back down, will we have another round of downsizing? Will we be asked to do more with even less? Increasingly in our industry, a company's success is measured increasingly by annual or even quarterly earnings. If company strategies are driven by a business plan that deploys economic capital for the sole purpose of optimizing the near-term return to shareholders, then where does technology—which has really brought us through this last decade, and enabled us to survive—where does technology fit into the equation?

Intellectual Capital

To an unprecedented extent, globalization of the world's economy has made a country's health and vitality dependent, not upon its political strength or military might, or even its natural resources, but mainly on its *intellectual capital.* I offer as Exhibit A some smaller countries of the Asian Pacific Rim, such as Singapore, where they have no natural resources and very little military or political might. I wonder, does this same theory hold true for companies? Intellectual capital is simply society's cumulative knowledge. We engineers and geoscientists are trustees of that portion of the knowledge base required to create the advanced technology that runs our world. This knowledge cannot simply be archived. To remain viable, it must be maintained, applied, and grown. In other words, intellectual capital requires a continuous investment.

Historically, three entities have been involved in the maintenance, application, and growth of intellectual capital: academia, engineering, and industry. Academia preserves and ensures integrity and passes on the knowledge to successive generations of engineers and scientists.

Engineers and scientists, through their experience and career-long education—I emphasis *career-long education* to young people in the crowd—learn to convert this knowledge to increasingly effective and advanced technological applications.

Industry's role is one of provider and supporter. Industry provides the environment for innovative engineering and professional growth. It supports, both directly and indirectly, the R&D effort required to expand the intellectual capital base, and supports the education process that furnishes our engineers and scientists. Academia, the engineering and scientific community, and industry are totally interdependent, where the failure of one directly impacts the performance of the other two.

Concerns About Industry

The current economic climate raises concerns about industry's role and, to some degree, the engineering and scientific community's role in maintaining the intellectual capital base. While the competitiveness spawned by economic globalization has placed a premium on intellectual capital, it has also resulted in round after round of cost-cutting, reorganizing, and downsizing in nearly all industries. I call this the "The Izing Process." For those of you who were in the natural gas industry in the '70s and early '80s, we were *full-sized* and proud as peacocks, were we not? In the mid-'80s, prices began to fall, so we started *reorganizing.* That didn't do it, so we started *downsizing.* Finally, we began to *right-size.*

The current focus on short-term shareholder return may represent the extreme of a business cycle. I have neither the qualifications nor the intent to discuss corporate business strategy. But as president of a technical society—whose primary mission is the maintenance and advancement of intellectual capital—I must use every opportunity to raise industry's awareness of the dangers of consuming the "seed corn." Those of you who are from a rural background know what it means to consume your seed corn. This is what comprises a company's real assets.

As Tom said, I recently returned from a very extensive speaking tour in northern Europe and the Middle East. As I traveled, I gave a talk with a similar message. No sooner did I get home than I read an article by Art Smith, who is CEO of John S. Herold. They are a leading economic analysis firm in the petroleum industry. I found Art Smith saying almost verbatim the same thing I am saying: concern about intellectual capital. This is interesting, coming from a Wall Street person. In fact, he coins the term "petroleum anorexia," referring to companies that look awfully lean and trim and fit, but underneath may have really serious threats to their prolonged existence. He acknowledges Wall Street's duplicity in this, to the extent that sometimes just the announcement of a personnel cut will raise a stock several points. As I travel and talk, I see more and more people raising the same concerns.

Our industry has become increasingly skillful in deploying economic capital. The question that is being raised, though, is: "Will we develop the technology required to make all of our wonderful projections come true?" In this February's issue of the *Journal of Petroleum Technology*, John Thorogood of British Petroleum focuses on some of the issues. For instance, the good technologists of yesterday are either retired or being kicked up to senior management level today. And their professionalism and knowledge is not necessarily being transferred to those who work under them. In addition, the career-development programs and continuing-education opportunities once offered by nearly every large oil company are disappearing. We run the risk of developing a new cadre of engineers who might be smart and well-educated, but are less acquainted with the technological gains of the last 15 years, less in tune with the technological requirements of the future, and less able to apply the rigorous engineering skills required. Without mentoring or other forms of nurturing, young engineers cannot gain a perspective much beyond their daily job requirement.

Colleges also get caught up in the business cycle, since many companies' recruiting goals and financial support to academia are tied to earnings-driven activity levels. This negatively impacts the stability and effectiveness of petroleum engineering programs and hampers greatly the recruitment of the high-quality student that this industry requires today.

This scenario is compounded by the dwindling R&D commitment across the industry. We are now enjoying the fruits of R&D done 15 or 20 years ago: 3-D seismic, horizontal drilling, multilateral, and on and on. This did not spring forth full-grown in recent years. This is stuff you can trace back 15 to 20 years or longer. Ten years from now, the scenario may be quite different. Company-run R&D projects have been cut in continual rounds of downsizing. Only a few remain intact, primarily in the hands of state oil companies. Research institutions and universities also have been impacted by industry downsizing.

Across the industry, results-orientated research has been replaced by application-oriented research. The implication of all this restructuring is not yet fully known. It is a complex issue. It is not simply a matter of a bunch of management consultants sitting around thinking of how can we save another dollar. Unfortunately, I think the net result of this will be a slowing in the growth of intellectual capital that our industry so desperately needs.

The advertising for this conference cites the need for a continued focus by the U.S. to support technological development for the natural gas industry. I think this is doubly true, in view of the greatly reduced R&D funding effort by private enterprise. This void can be filled only through a cooperative effort by both industry and government. In the past, the message of the major oil companies to government was "Give us relief from the onerous tax burden and we will handle our own R&D." But this no longer appears to be an option. The government budget for upstream R&D is a fraction of DOE's total budget, yet it stays under continual political attack.

I know from my own involvement in a Class 2 oil reservoir project that some of DOE's programs are very practical and very cost-efficient, and have given the taxpayer a lot of bang for the buck. Many DOE-supported projects already are bringing forth new technology, which is being transferred to the public domain in real time. I think this conference is evidence of that. There is a valid and very necessary role for government in the maintenance and growth of intellectual capital—not to assume the R&D burden, but to coordinate, facilitate, and encourage industry-driven initiatives.

While we have by no means spent all of our intellectual capital, we must sustain and nurture it to survive. This is becoming harder and harder as traditional avenues disappear, such as career-development programs, continuing-education opportunities, and development funding. This is why a renewed and sustained commitment of industry support is fundamental to our survival. This is why dialogue—specifically, the dialogue printed under the auspices of technical societies—is so vitally important. Through their publications, meetings, short courses, forums, advanced technology workshops, and other means, technical societies serve a vital function of the upstream industry. With the continued disappearance of traditional means of continuing education and dissemination of technology, these societies have become a primary vehicle for the sustenance and growth of our intellectual capital.

For example, by disseminating the latest technology to its members worldwide, the Society of Petroleum Engineers now fulfills many functions once performed in-house by most larger companies. SPE's primary mission is to gather, disseminate, and exchange petroleum technology. We have acquired considerable expertise in these areas. SPE is anxious to cooperate, both with public entities and governmental entities, in disseminating technology, staging technical events, exchanging data, and providing career-growth opportunities for individuals throughout our industry.

The continuing ability of industry to fulfill its requirement for advanced technology depends upon dual commitments. First, engineers and geoscientists must accept their responsibility to grow technically and professionally throughout their career. This includes active participation in technical societies. Second, management must recognize that the future depends on maintaining and expanding our intellectual capital. Management must be willing to invest in this capital base, through good times and bad, by supporting and encouraging, both in word and deed, their employees' professional growth, industry's R&D effort, and the educational process. Truly, there are no free lunches. Thank you very much.

THERE AIN'T NO FREE LUNCHES

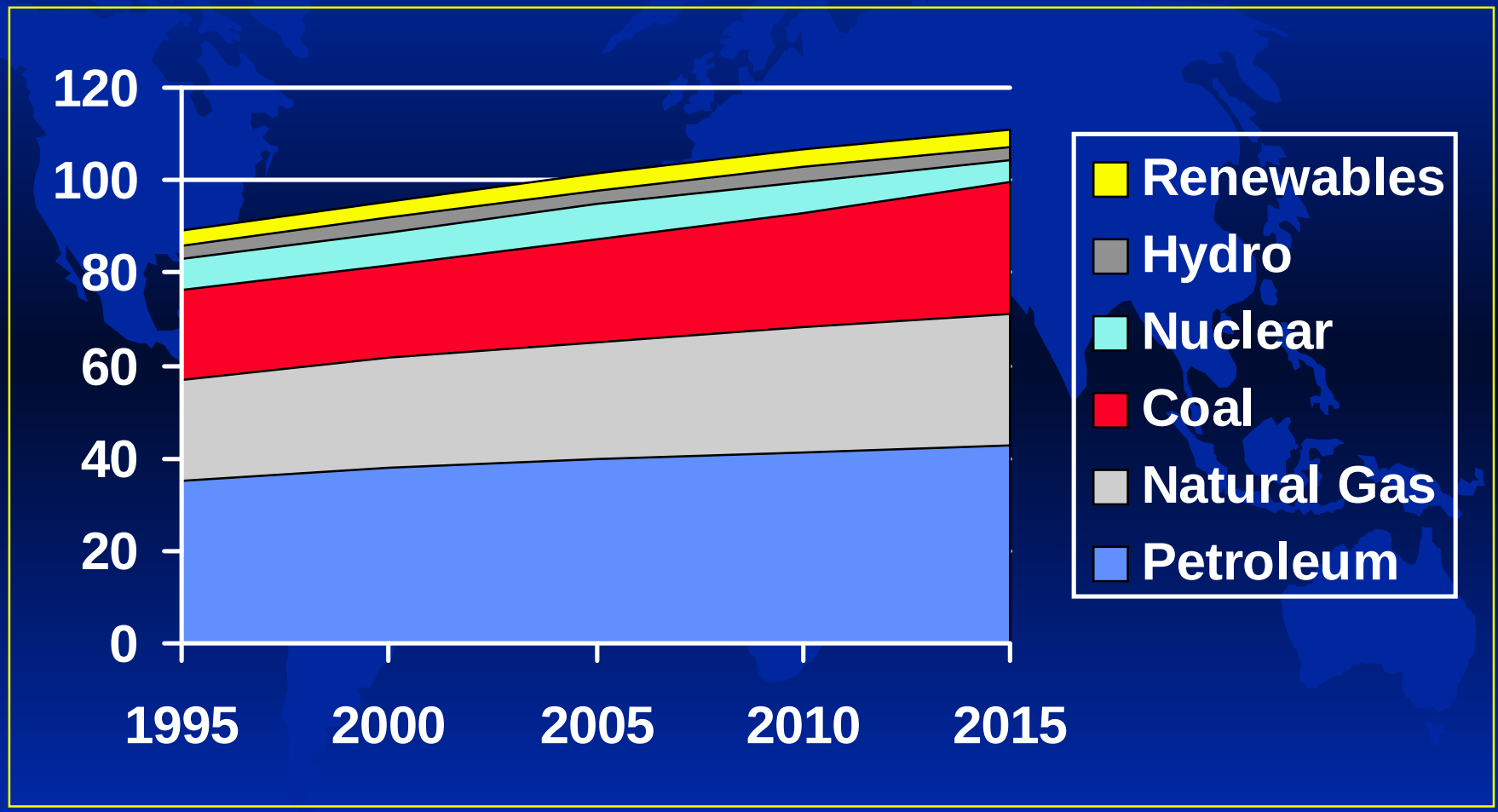
Natural Gas Conference
DOE

Houston, Texas
March 24–27, 1997

T. Scott Hickman

U. S. Energy Demand

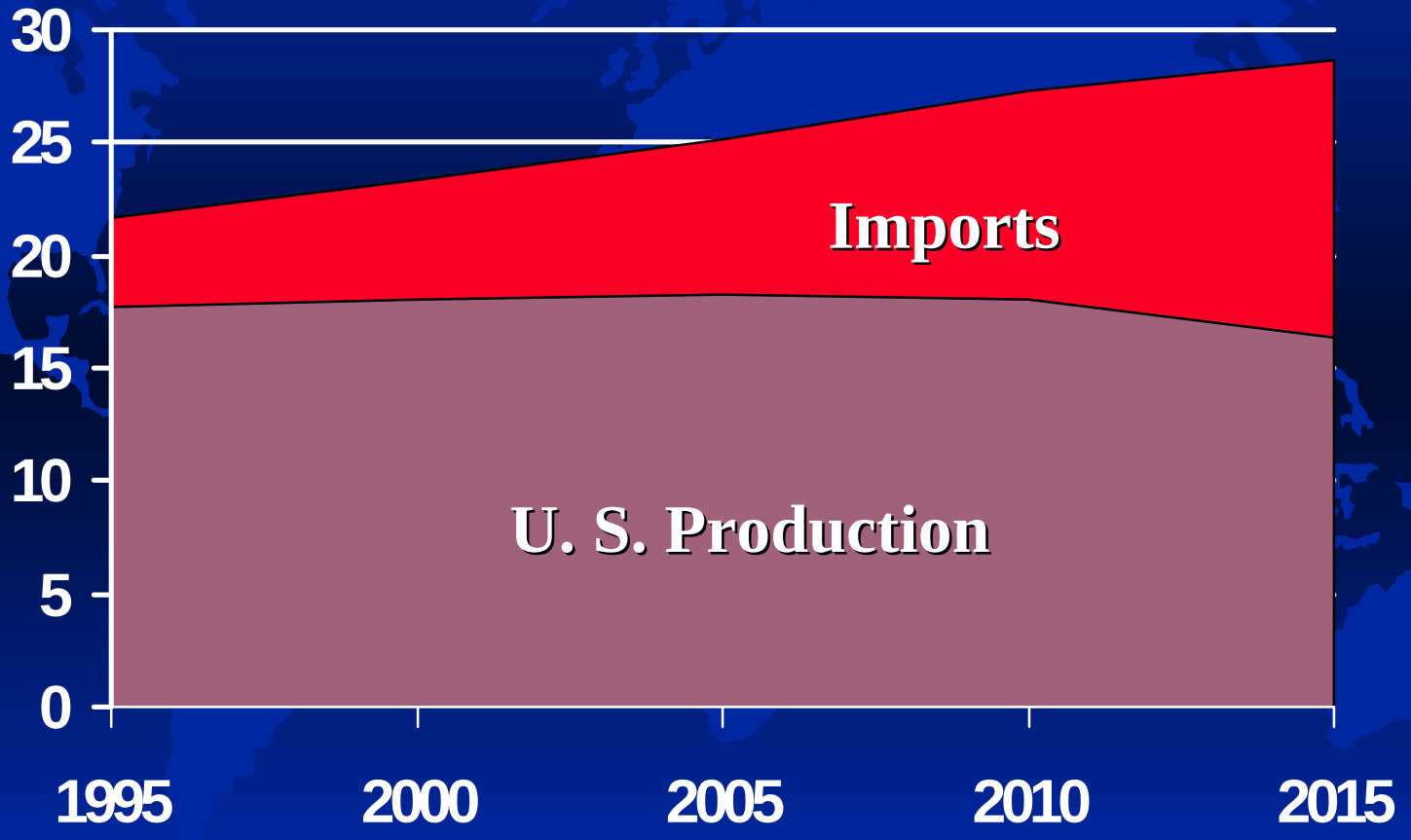
(Quadrillion Btu)



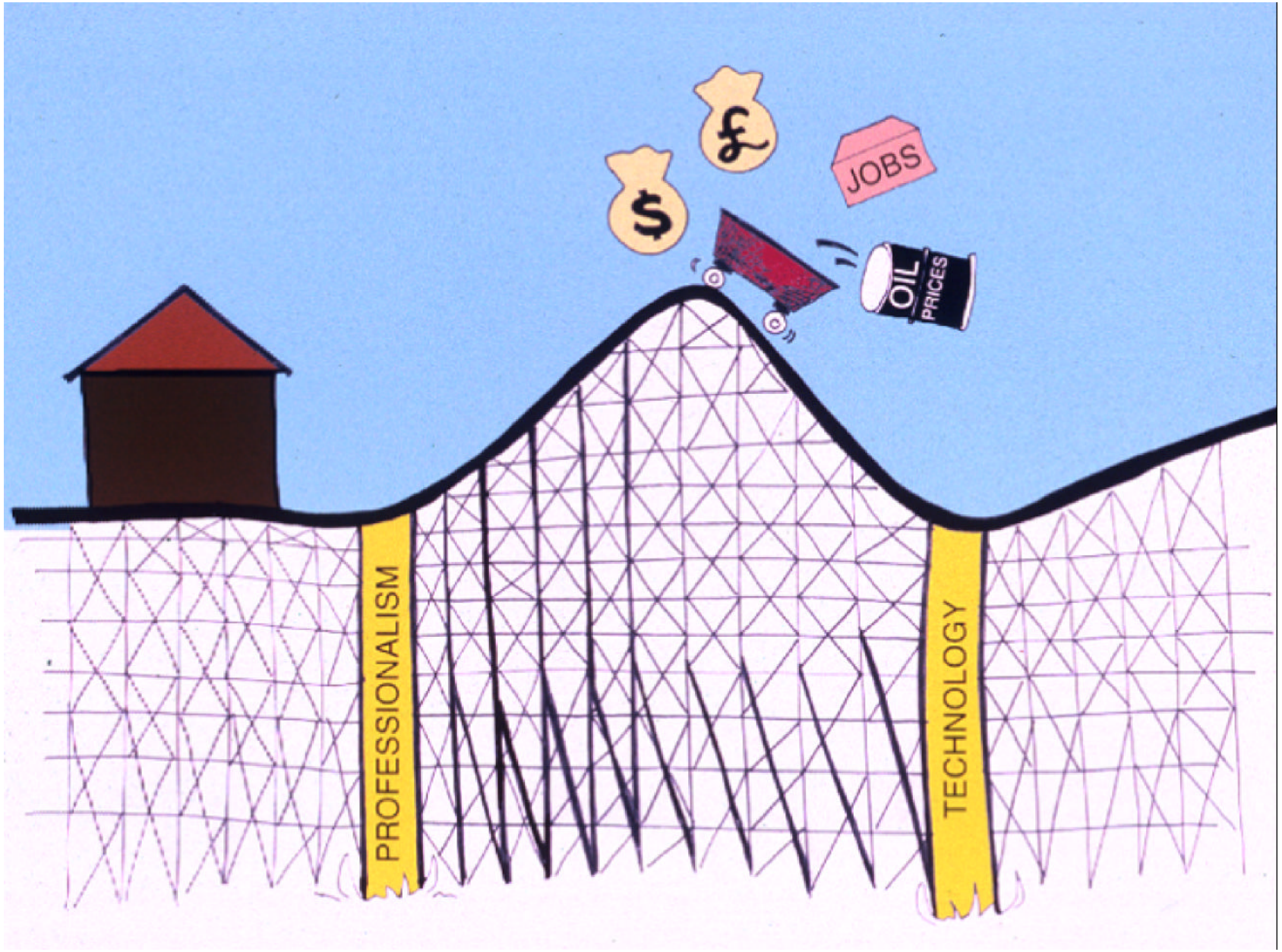
Source: Gas Research Institute, *Baseline Projection Data Book*, 1996

U.S. Natural Gas Demand, Production, Imports

(Quadrillion Btu)



Source: Gas Research Institute, *Baseline Projection Data Book*, 1996


£
$
JOBS
OIL
PRICES
PROFESSIONALISM
TECHNOLOGY

How Did We Do It?

- Dedicated Professionals
- Effective Use of Existing Technology
- Developed Advanced Technology

SPE International
Society of Petroleum Engineers

Into the Future

- What if 1997 Prices Weakened
- Incompatible Strategies
  - Short-term Optimization of Shareholders Return
  - Developing Advanced Technology
- Intellectual Capital
  - Key to Advanced Technology

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Society of Petroleum Engineers

Academia

- Preserves Knowledge
- Protects Integrity
- Educates Engineers

SPE International
Society of Petroleum Engineers

Engineers

- Obtain Knowledge Base
- College Education
  - Experience
  - Career-Long Learning
- Convert Knowledge
  - Efficient Applications
  - Advanced Technology

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Industry

- Provides Environment
  - Innovative Engineering
  - Professional Growth
- Supports
  - R&D
  - Education

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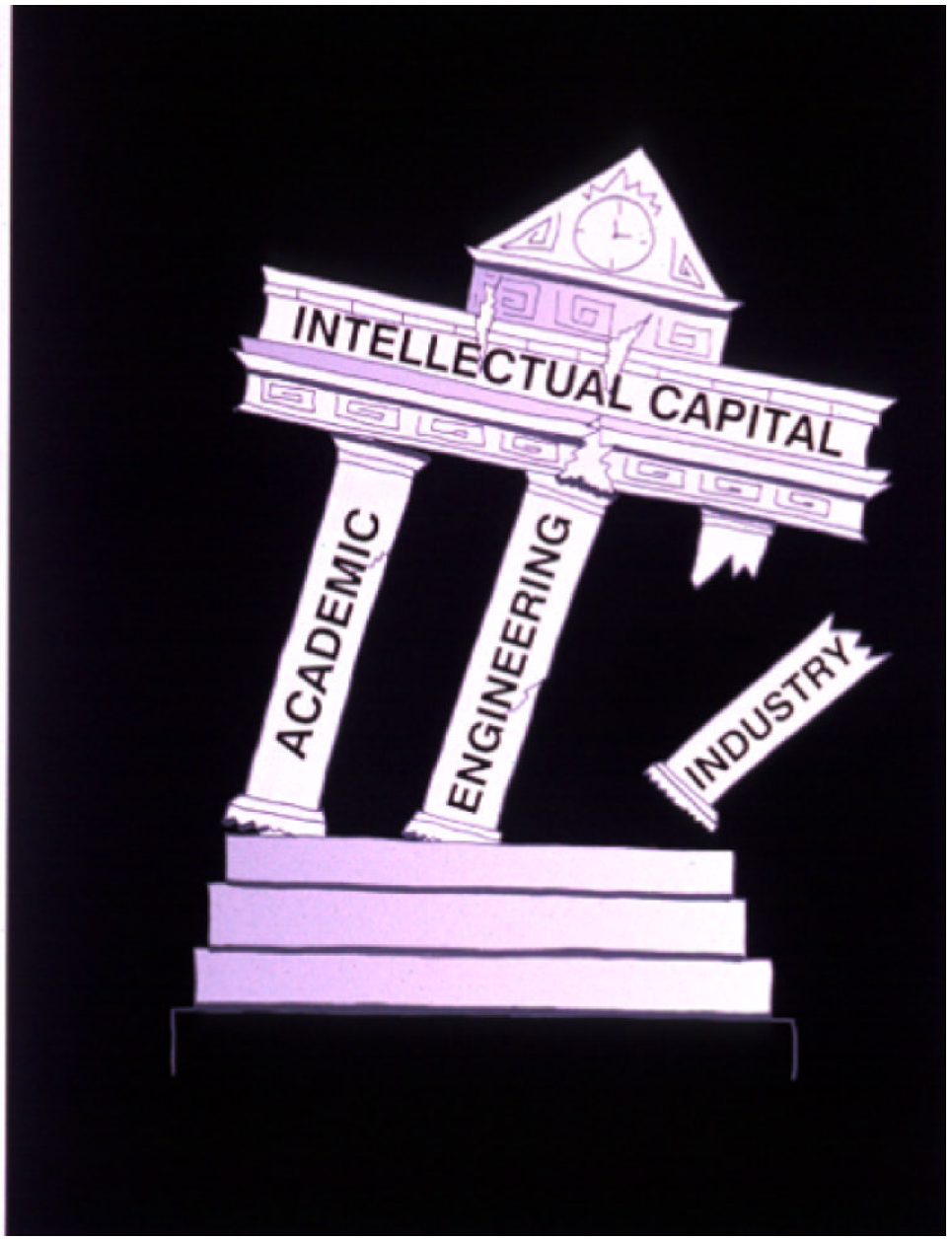
The Future?



The "Izing" Process

Full-Sized

Reorganized

Downsized

Right-Sized?

Concerns About Industry

- Low Prices = Downsizing
- Competitiveness = Short-term Focus
- Consuming "Seed Corn"
  - Lack of Nurturing Young Engineers
  - Cyclic Support of Education
  - Reduced Commitment to R&D

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WE
SURVIVED

PROFESSIONAL SOCIETY'S ROLE

- Replacing In-House Functions
- Activities Create Vital Dialog
- Primary Vehicle for Maintaining Intellectual Capital

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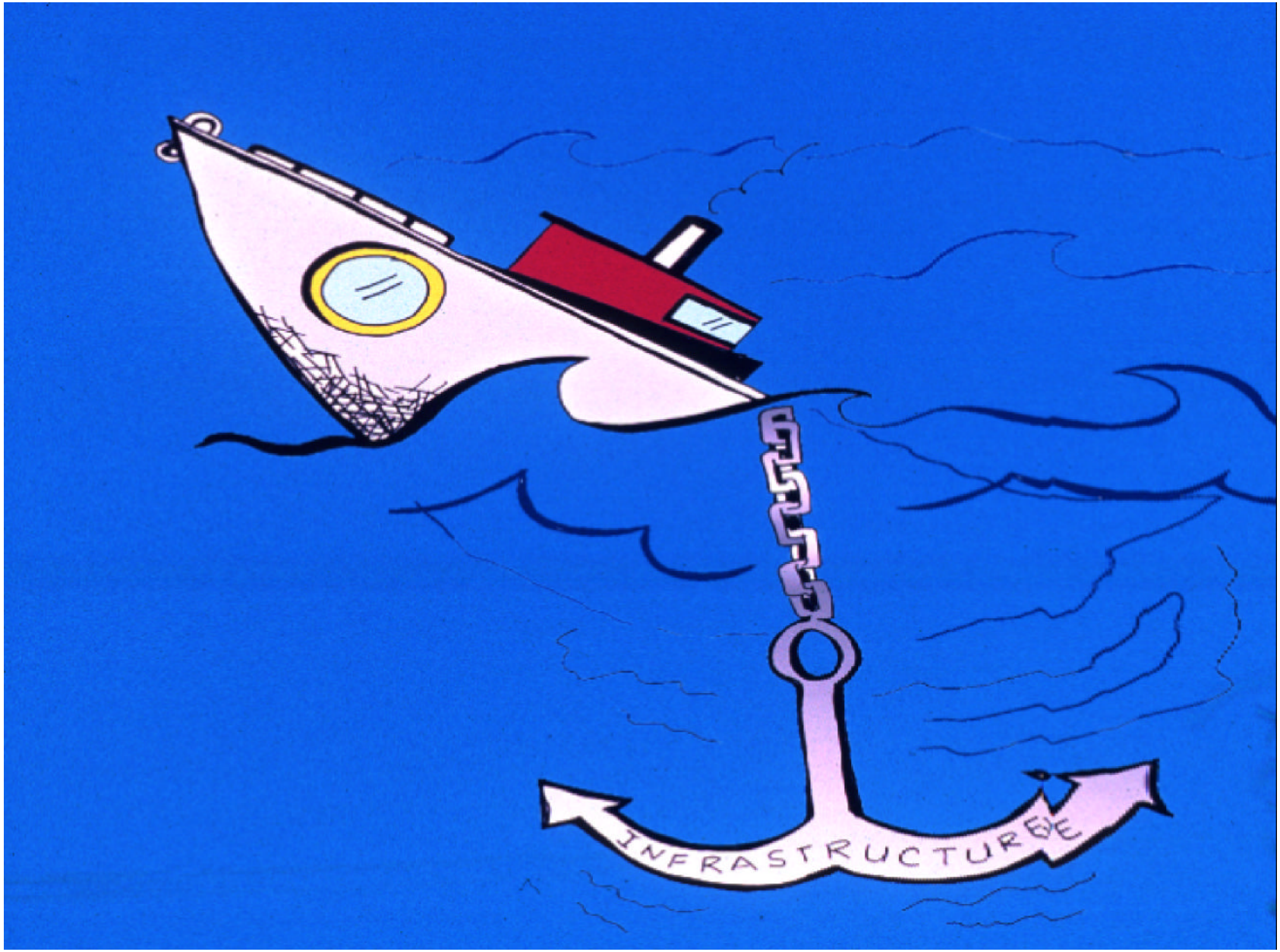
INFRASTRUCTURE